

~~DISTINCTIVE PROTECTIVE HEADGEAR~~
HELMET WITH OPAQUE INNER LAYER, TRANSLUCENT OUTER LAYER,
AND PATTERNING THEREBETWEEN

TECHNICAL FIELD

4 This invention relates to protective headgear bearing embedded
5 distinguishable marking, such as alphanumeric data, color patterns,
6 and stylized designs, for ready identification to headgear viewers.

7 BACKGROUND OF THE INVENTION

8 Nearly everyone must be aware that various kinds of people wear
9 protective headgear, examples being bicycle and motorcycle riders,
10 construction workers, firemen, mine workers, players of so-called
11 contact sports, race drivers, soldiers, and members of other groups,
12 identifiable by their type of clothing or markings attached thereto.

13 A disadvantage of much headgear marking is lack of permanence,
14 inasmuch as the wearers' own activities often tend to fade, degrade,
15 or remove the identifying markings, partially if not completely.

Attempts have been made from time to time to ameliorate--if not to eliminate entirely--such degradation of headgear marking, and to

19 Examples identified in U.S. patents include multilayered headgear by
20 Cleveland, 3,437,631; Rodell, 3,445,680; Gesselin, 4,466,138; Tung,
21 3,885,246; Johnson, 3,946,441; Luna 4,008,949; Mitchell, 4,599,752;
22 and Gentes, 4,993,082. Johnson, Rodell, and Mitchell disclose two-
23 piece separable headgear; Gesselin teaches an inseparable two-piece;
24 Cleveland teaches pigmentation of headgear compositions; Tung, Luna,
25 and Gentes illustrate layering of reflective materials in headgear.

26 Despite improvements contributed by those inventors or others,
27 headgear tends to carry no marking, or only relatively uninformative
28 all-over marking, or informative marking susceptible to damage/loss.

2

1 **SUMMARY OF THE INVENTION**

2 A primary object of the present invention is to provide protective headgear, distinctive by bearing customized alphanumeric and/or 3 design marking, made up of informative and/or decorative patterning.

5 Another object of this invention is to embed a distinguishable 6 marking into the headgear so that even substantial surface damage to 7 the headgear will be unlikely to impair such marking.

8 A further object of the invention is to distinguish wearers of 9 headgear, as by company affiliations, sports teams, and/or emergency 10 crews, for example, clearly enough to avoid mistaking members of one 11 such group for members of another such group, or even to distinguish 12 each member from every other member of the same group.

13 Yet another object of this invention is to attain the foregoing 14 objects without sacrificing, or while actually enhancing, safety or 15 security aspects provided by such protective headgear.

16 A still further object of the invention is to accomplish the 17 foregoing objects with little or no increase in cost, or with actual 18 reduction in headgear costs.

19 In general, the objects of the present invention are attained, 20 in composite protective headgear, by first providing a thin sheet of 21 durable plastic composition carrying at one of its faces (perhaps 22 impregnated with) decorative and preferably informative visible patterning, forming such sheet into headgear shape, and covering a face 23 of the formed sheet with a preferably thicker layer of solidifiable 24 plastic composition, solidifying that composition in place, and thus 25 forming a more durable composite headgear structure, with patterning 26 visible through an overlying translucent layer to outside observers.

1 More particularly, converting the patterned sheet into headgear
2 shape is preferably accomplished by thermo-forming, and the covering
3 of one of its faces with the thick solidifiable layer preferably is
4 accomplished by injection molding. Alternatively, the components
5 might be layered together and then be formed into headgear shape in
6 a single step, as by suitable molding, perhaps not so practicable in
7 the present state of the art--although it might become preferable.

8 If the patterned sheet is to be at the outside of the headgear
9 (as is acceptable for all except the roughest environments), the
10 sheet is desirably translucent and carries the patterning on its con-
11 cave face, to be covered by the solidifiable plastic composition,
12 which is opaque (preferably white) to set off the pattern visually.

13 If the headgear is to be subjected to excessive abrasion, the
14 patterned sheet is preferably located at the inside of the headgear,
15 is preferably opaque, with patterning on--possibly impregnating--its
16 own convex surface, and the solidifiable outside layer is desirably
17 translucent to render the patterning visible to an outside observer.

18 A headgear of this invention is characterizable as a unitary
19 laminate, having been formed into generally hemispherical headgear
20 shape, and including distinctive patterning readily visible to those
21 exterior observers viewing its convex outer surface.

22 Preferably, such distinctive patterning is intentionally dis-
23 torted initially (when flat), to become substantially undistorted to
24 a viewer in its resulting generally hemispherical headgear shape.

25 Other objects of this invention, together with means and meth-
26 ods for attaining the various objects, will become apparent from the
27 following description and the accompanying diagrams presented by way
28 of example rather than limitation of embodiments of this invention.

4

1 **SUMMARY OF THE DRAWINGS**

2 Fig. 1 is a sectional elevation of a sheet of durable plastic
3 material of this invention, patterned along one face only;

4 Fig. 2 is a series of side sectional elevations of the sheet of
5 Fig. 1 being formed into substantially hemispherical configuration
6 in a female mold preparatory to having its patterned face covered;

7 Fig. 3 is a series of side sectional elevations of the sheet of
8 Fig. 1 being formed into substantially hemispherical configuration
9 on a male mold preparatory to having its patterned face covered;

10 Figs. 4A and 4B are side sectional views of a uniformly grid-
11 patterned sheet formed as in Fig. 2 and representing, respectively,
12 the normally resulting distorted pattern appearance, and a preferred
13 pre-distorted pattern to compensate for shaping-induced distortion;

14 Figs. 5A and 5B are side sectional views of a uniformly grid-
15 patterned sheet formed as in Fig. 3 and representing, respectively,
16 the normally resulting distorted pattern appearance, and a preferred
17 pre-distorted pattern to compensate for shaping-induced distortion;

18 Fig. 6 is an elevation of the shaped headgear of Fig. 4 or 5,
19 before trimming away of flashing, showing a resulting undistorted
20 grid pattern appearing distorted only by being viewed straight on;

21 Fig. 7A is a thickness cross-section view of relatively heavy-
22 duty headgear, patterned nearer its inner than its outer surface;

23 Fig. 7B is a thickness cross-section view, of relatively light-
24 duty headgear, patterned nearer its outer than its inner surface;

25 Fig. 8 is a bottom plan of the headgear of this invention with
26 harness or suspension recesses on its inner surface;

27 Fig. 9 is a side elevation of the headgear of Fig. 8 (pattern
28 omitted) with outside bosses corresponding to the inside recesses;

1 Fig. 9A is a fragmentary section through the headgear of Fig. 9
2 taken at IXA-IXA on Fig. 9;

3 Figs. 10A and 10B are, respectively, a face elevation and a
4 side elevation of a fastener to fit into a fastener-receiving recess
5 in the headgear of Fig. 8;

6 Figs. 11A and 11B are partial medial sectional elevations fore-
7 to-aft through the headgear of Fig. 8, with suspension harness and
8 foamed liner, respectively, installed in the headgear interior;

9 Fig. 12 is a block diagram of the processing of the starting
10 materials into the headgear of this invention.

11 **DESCRIPTION OF THE INVENTION**

12 Fig. 1 shows, in sectional elevation (thickness exaggerated),
13 sheet 10 of durable plastic material of this invention having, along
14 one of its opposite faces only, distinctive intermittent pattern 11,
15 optionally impregnating the face to a limited depth.

16 Fig. 2 shows, in side sectional elevation, thermo-forming
17 female mold 12, bridged (in phantom) by successive positions of flat
18 starting sheet 10', its subsequent first central sagging configura-
19 tion 20, its further sagging intermediate configuration 20', and (in
20 solid section) substantially semicircular final cut of its resulting
21 configuration 20"--getting progressively thinner at their midpoints.

22 Fig. 3 shows, in side sectional elevation, male mold 13,
23 bridged similarly by flat starting sheet 10", subsequent first
24 peripheral sagging configuration 30, intermediate further sagging
25 configuration 30', and (in solid section) final substantially semi-
26 circular final cut of its resulting upright hatlike hemispherical
27 configuration 30". Each section is somewhat thinner at its junction
28 to the remaining flat peripheral part than its last predecessor was.

1 In both Figs. 2 and 3, most of the remaining flat (unshaped)
2 portions constitute flashing that eventually is removed by stamping
3 or a similar operation, leaving the headgear-shaped body portion.

4 Figs. 4A and 4B show side sectional views of a uniformly grid-
5 patterned sheet formed as in Fig. 2 and representing, respectively,
6 the normally resulting distorted pattern appearance, and a preferred
7 pre-distorted pattern to compensate for shaping-induced distortion;
8 Thus, if the starting sheet has a uniform grid pattern, the forming
9 of that sheet will distort the pattern as shown in Fig. 4A, wherein
10 the originally parallel central portions of the grid become spaced
11 too wide apart, as shown in Fig. 4A, and decrease progressively in
12 spacing when further from the center. In order to produce a uniform
13 grid (or other pattern) in a resulting headgear shape, an oppositely
14 pre-distorted starting pattern should be used, as shown in Fig. 4B.

15 In Figs. 4A, 4B, 5A, 5B, grid crowding and curving attributable
16 to surface non-perpendicularity to the line of sight are minimized,
17 to emphasize stretching of the grid attributable to sheet thinning.

18 Figs. 5A and 5B show side sectional views of a uniformly grid-
19 patterned sheet formed as in Fig. 3 and representing, respectively,
20 the normally resulting distorted pattern appearance, and a preferred
21 pre-distorted pattern to compensate for shaping-induced distortion;
22 Thus, such forming will result in the distorted pattern of Fig. 5A,
23 wherein the grid lines become spaced further apart along a ringlike
24 locus of bending at the crown level. Such a localized distortion
25 becomes progressively less at both greater and lesser distances from
26 that ringlike crown locus. Hence, to reproduce a uniform grid in a
27 resulting headgear shape, an oppositely distorted starting pattern,
28 such as shown in Fig. 5B is preferably employed in this invention.

1 As explained below, pattern distortion from forming the flat
2 sheet into generally hemispherical headgear shape is pre-calculated
3 to counteract unevenness of forming the sheet including the pattern,
4 so the pattern on the resulting headgear is as regular as desired.
5 Of course, if somewhat ellipsoidal or ovoidal headgear is to result,
6 distortion relative to the conventional planar (x,y) axes of the
7 sheet (not so marked) in Figs. 4A and 4B, and in Figs. 5A and 5B,
8 will be unequal proportionately along the respective axes to appor-
9 tion (or to compensate for) the desired degree(s) of eccentricity.

10 Fig. 6 shows, in elevation, the headgear of either Fig. 4 or 5,
11 with the resulting pattern substantially undistorted. The apparent
12 distortion is essentially uniform in any elevational view for hemi-
13 spherical headgear, and is usually correctly interpreted visually.
14 A slightly ellipsoidal or ovoidal headgear would be closely similar.
15 The grid-free edge portions are flashing remnants to be trimmed off.

16 Figs. 7A and 7B are fragmentary thickness sections of resulting
17 headgear in which relative positions of a thin patterned sheet and a
18 thick impact-resistant solidified layer are interchanged between the
19 concave inner surface and the convex outer surface of the headgear.

20 Fig. 7A shows fragmentarily a thickness section of heavy-duty
21 headgear of this invention, with thick impact-resistant layer 74 at
22 convex outer surface of the headgear, thin layer 72 as its concave
23 inside face and carrying patterning 73 between the two layers and
24 preferably opaque if impregnating by the patterning itself.

25 Fig. 7B shows a similar section of light-duty headgear having
26 thin translucent layer 78 forming its convex outside face, carrying
27 patterning 77 at (not impregnating) its concave inner surface, which
28 adjoins the convex surface of preferably opaque thick layer 76.

1 The terms "light-duty" and "heavy-duty" in this description are
2 exemplary rather than limitative, because both composition and thick-
3 ness contribute to durability, so various trade-offs are possible.

4 The patterning feature of this invention is ignored in all the
5 rest of the illustrative views, which are directed to conventional
6 protective headgear features, except that the final block diagram,
7 which recapitulates steps and apparatus of the present invention.

8 Fig. 8 shows, in bottom plan, headgear 80 of this invention,
9 featuring bill 81 extending to the right (forward, on a fore-to-aft
10 axis) and recesses 82, 84, 86, and 88 for fasteners of a suspension
11 harness on its inner surface, evenly spaced at the bisectors of each
12 quadrant. The generally hemispherical shape of the headgear is ap-
13 parent in this view from the even circular spacing of the recesses.
14 Each recess is adapted to receive and removably retain a conven-
15 tional fastener (not shown here) when inserted thereinto.

16 Fig. 9 shows, in fragmentary side elevation, the same headgear
17 having visible external bosses 92, 94, corresponding to internal
18 recesses 82, 84 of the previous view.

19 Fig. 9A shows fragmentarily a sectional elevation through boss
20 94 over recess 84 of the same headgear, with the headgear cross-
21 section shown as single plastic layer 81 more nearly in scale than
22 in the views where component layers of the composite were visible.

23 Figs. 10A and 10B show conventional fastener 100 in elevation
24 face-on and edgewise, respectively. The fastener is generally rec-
25 tangular with rounded corners at one end to facilitate insertion,
26 with slot 101 adapted to receive and retain an individual strap of a
27 suspension harness, and with enlargement along its opposite end to
28 provide a grip to facilitate its removal.

1 Fig. 11A shows, in partial cutaway fore-to-aft medial sectional
2 elevation, assembly 110 comprising headgear 80 of this invention,
3 with its composite shell 81 shown simplified, and with suspension
4 harness 110 including encircling headband 111, head cap 115, and in-
5 terconnecting straps 110. Thus, the headgear is spaced away from
6 the head, as is customary for improved ventilation and enhanced
7 safety in the event of headgear impact.

8 Fig. 11B shows, in a similar view of assembly 120, comprising
9 headgear 80 with simplified showing of its shell 81, and with solid
10 foam liner 89 installed along the inside surface thereof, thicker
11 overhead and progressively thinner down the sidewall. The liner is
12 secured adhesively or by other bonding with the inside wall.

13 If desired, both the Fig. 11A and the Fig. 11B additions may be
14 combined to provide a solid foam liner and a suspension harness, and
15 any of the assemblies may be provided with a conventional chin strap
16 (not shown here) retained by a clip to the headgear or otherwise.

17 Fig. 12 is a block diagram of the processing of the starting
18 materials into headgear of this invention. The following description
19 of this view supplements the description of the preceding drawings
20 and will explain further how to make this very distinctive headgear.
21 Reference numerals are omitted from this description as superfluous.

22 The step SELECT SHEET (top center) is followed by APPLY PATTERN
23 (as by silk screening or surface impregnation of the thin sheet).
24 Next, the patterned sheet passes either to T-FORM MALE or to T-FORM
25 FEMALE as in Figs. 3 and 2, respectively, for corresponding thermo-
26 forming. If the resulting pattern is unsatisfactory the article can
27 be sent as a guide to a REVISE PATTERN step. (If intended only as a
28 toy or for visual display, the article can go to TRIM OFF FLASHING.)

1 Normally though, the patterned surface of the intermediate thermo-
2 formed article is usually covered with solidifiable plastic in the
3 INJECT MOLD step. When the T-FORM MALE intermediate product is
4 selected, it receives clear plastic from the INJECT CLEAR step fol-
5 lowing the SELECT CLEAR step at the upper left. Otherwise, the
6 T-FORM FEMALE intermediate product receives opaque plastic from the
7 INJECT OPAQUE step following the SELECT OPAQUE step (upper right).
8 The product from either mold goes to TRIM OFF FLASHING, completing
9 formation of the headgear shell. Additional steps are shown for
10 both a hard hat type of protective headgear, at the left, as INSTALL
11 HARNESS and optional (broken line) INSTALL CHIN STRAP; and for a
12 sports helmet the INSTALL FOAM solid pad step followed by the IN-
13 STALL CHIN STRAP step. Alternatively both the solid foam and the
14 suspension harness may be installed, with or without chin strap.

15 Optionally T-FORM and/or INJECT MOLD step(s) may be modified or
16 be replaced by equivalent forming steps, or a single composite step,
17 such as an all- injection (or equivalent) technique, while retaining
18 all or some of the advantages and benefits of the present invention.

19 The headgear of this invention (excluding foamed padding, etc.)
20 may measure as little as several mm. or about one-eighth inch thick,
21 the patterned sheet being about a tenth of such thickness, or about
22 a dozen mils; alternatively up to as much as about twice that thick.

23 The compositions and other materials for practicing the present
24 invention are all readily available through normal trade channels.
25 Besides some already mentioned, the Cleveland patent discloses other X
26 potentially useful polymeric compositions for the starting sheet.
27 Cleveland also discloses inorganic pigments, organic pigments, and
28 inorganic salts of organic pigments useful for patterns as herein.

1 My preferred headgear compositions include alkylanes, such as
2 high-density polyethylene (HDPE), polycarbonates, such as GE's
3 LEXAN® brand thereof, also acrylonitrile-butadiene-styrenes (ABS) or
4 polyvinyl chlorides (PVC). Whichever is/are chosen should meet or
5 exceed impact-resistance and also electrical resistance requirements
6 for protective headgear. Ridges and like structural reinforcement
7 can be built into the headgear of this invention--but they are not
8 structurally necessary, as all strength requirements are met anyway.

9 The desired ^{patterning} ~~patterned~~ can be accomplished in a number of ways.
10 My preference, when the sheet is to remain translucent, is to print
11 the distinctive design on the sheet, which can be done well enough
12 by conventional silk screening with thermally stable inks.

13 A desirable alternative is sublimation printing, where the inks
14 impregnate the sheet (usually not translucent) to a depth of several
15 mils. As thermo-forming heats the sheet anyway, the printing step
16 can just precede the thermo-forming (or perhaps even be combined).
17 Suitable sublimation inks are well known, such as disclosed in U.S.
18 Patents 4,042,545; 5,250,494; 5,270,284; 5,382,561; and 5,391,536.
19 Also see U.S. Pat. 5,311,816 for more about sublimation printing.

20 Thermo-forming and injection molding are conventional processes
21 that are so well known as not to need any further commentary here,
22 notwithstanding that individual processors may have preferred ways
23 of operating, not necessarily generally known in their trade.

24 Another embodiment of this invention enables distinctive fore-
25 ground pattern and a partial or an all-over background pattern, such
26 as marbling or stippling, or reflective micro-beads, or a diamond or
27 similar geometric pattern, to be superimposed on a single sheet, or
28 on separate sheets juxtaposed before or during thermo-forming.

1 The durability of the headgear of this invention reduces the
2 overall cost of maintaining a presentable appearance, not only for
3 the user's own satisfaction but also for the public impression that
4 it makes, as is especially important when protective headgear is man-
5 dated as part of a uniform or other attire in business or industry,
6 sports or entertainment, civic or military service, etc.

7 The advantages of almost indestructable distinctive patterning
8 of protective headgear are hard to overstate, especially as compared
9 with the faded, peeling, scratched, and otherwise degraded indicia
10 on many a sports team's helmets or a construction crew's hardhats.
11 Not only can a team or corporate affiliation be readily indicated,
12 as on the side or front of the headgear, but an individual's name,
13 number, rank, etc. can be shown on the side or back, for example.

14 Preferred embodiments and variants have been suggested for this
15 invention. Other modifications may be made, as by adding, combin-
16 ing, deleting, or subdividing compositions, parts, or steps, while
17 retaining all or some of the advantages and benefits of the present
18 invention--which itself is defined in the following claims.